8-1976

The Influence of Multiple Variables on the Protestant Ethic Effect

Gloria Rice
Western Kentucky University

Rice,

Gloria Slonaker

1976

THE INFLUENCE OF MULTIPLE VARIABLES ON THE PROTESTANT ETHIC EFFECT

A Thesis

Presented to

the Faculty of the Department of Psychology

Western Kentucky University

Bowling Green, Kentucky

In Partial Fullfillment

of the Requirements for the Degree

Master of Arts

by

Gloria Slonaker Rice

August, 1976

THE INFLUENCE OF MULTIPLE VARIABLES

ON THE PROTESTANT ETHIC EFFECT

Recommended 7-28-76

James L. Craig
Co-Director of Thesis

Leroy Meyer
Co-Director of Thesis

David A. Stier

Approved 8-3-76

Elmer Gray
Dean of the Graduate College

Table of Contents

List of Illustrations

The Influence of Multiple Variables

on the Protestant Ethic Effect

Gloria Slonaker Rice August, 1976 28 pages

Directed by: James R. Craig, Leroy P. Metze, and

David A. Shiek

Department of Psychology Western Kentucky University

Research has shown that under certain conditions an organism will prefer to work for a reward rather than free-load for the identical reward. Length of barpress training, type of reinforcer, and strain of rat have all been shown to affect work behavior. Six Wistar and six Max Hooded rats were assigned to one of three treatment conditions. They earned either a water or a sucrose reinforcer for 5, 7, or 10 days. The rats were given two days of barpress shaping. Following barpress shaping, they completed 5, 7, or 10 days of barpress training. Training was followed by three days of choice testing in which the rat could continue to earn liquid reinforcer or receive it without work. Differences between the findings of the current study and previous studies were suggested as being due to different training procedures, different utilizations of the reinforcer sucrose, and preferences different strains may have for different reinforcers. There was a significant difference in the amounts of reinforcer consumed.

Twice as much sucrose was consumed under all treatment conditions. Suggestions for further investigation included: a comparison of massed and distributed barpress training, exploration of the relationship between strain of rat and type of reinforcer employed, and a comparison of different presentations of sucrose.

Chapter 1

Review of the Literature

The term "Protestant Ethic Effect" (PEE) has been coined by researchers to refer to an organism's preference to work for reward rather than obtain the same reward without work (e.g., Singh, 1972; Stephens, Metze, & Craig, 1975). Work, as defined by these researchers, has usually been a motor activity, such as barpressing or running a maze, whereby the organism may earn a reward. Typically, the reward used has been food and the environment has been arranged so that the organism has the option to emit the motor task (work) to receive food or to receive the identical reward without working (freeload).

Using food as a reinforcer, Havelka (1956) was the first to observe the PEE. He trained 50 rats in a goal box with two cross-shaped barriers. By placing food in different angles of the two barriers, he offered the rats two alternative routes to the same goal. One alternative offered a maze which contained a direct route to the goal whereas the other was a longer, more complicated path in which the location of the food goal varied from trial to trial. Havelka found that one-third of the rats chose the shorter, more direct route to the fixed goal. One-third chose the longer, more complicated route to the variable goal, and the re-

mainder had no preference. Havelka explained these findings in terms of an intrinsic appeal for problem solving for the rats.

Variables Which Affect the PEE

Generally, the animal studies concerned with the PEE allow the subject a choice between performing some operant response, such as barpressing, or simply eating food pellets from a food dish. While all studies have some form of this choice situation in common, many variables have been manipulated. Variables which have received attention include: habit strength of both the working and freeloading responses prior to a testing period (e.g., Jensen, 1963; Stolz & Lott, 1964; Leung, Jensen, & Tapley, 1968), length of deprivation (e.g., Neuringer, 1969), reinforcement schedules (e.g., Carder & Berkowitz, 1970; Davidson, 1971; Alfering, Crossman, & Cheney, 1973), and the strain of rat (e.g., Hanel, Note 1).

Work history. After Havelka (1956), Jensen (1963) also hypothesized that rats may actually prefer to work rather than freeload for food. He varied the habit strength of the working response by allowing different amounts of barpress training prior to a choice situation. He placed 200 food deprived rats in a barpress training situation and in another situation where they could eat freely from a food cup. The rats were trained on 40, 80, 160, 320, 640, or 1280 reinforced responses to the barpress. Following the training sessions, the rats were placed in a two choice situation where they could eat freely from a food cup or obtain iden-

tical food by barpressing. The group which received 40 rewarded presses worked for approximately 20% of its food and the group which received 1280 rewarded presses worked for approximately 75% of its food. It was noted that only one of the 200 subjects run by Jensen ate 100% of its food from the free food dish. Jensen found that, in general, an increasing linear function could be used to describe the relationship between the number of rewarded presses during training and the number of pellets obtained by barpressing in the choice situation. That is, the more barpresses the rat made in training to receive food, the more barpresses he was likely to make to obtain food during testing. The results of the study indicated that a definite preference to earn food by barpressing existed. Jensen explained these results in terms of the intrinsic appeal or satisfaction that the rats received for earning the food rather than eating it freely from the food dish.

Instead of using barpressing as the work mode as did Jensen (1963), Stolz and Lott (1964) defined work as running to a goal box. Thirty-seven rats were randomly divided into four groups which were given different amounts of training before testing. One group had received no preliminary training prior to being placed in the testing situation. During testing, a pile of food pellets was placed halfway down a runway in such a manner that the rat would have to run over the pellets in order to obtain the single pellet reward in the goal box. Stolz and Lott

found that the rats which were trained prior to the testing situation ran over the pellets in the runway in order to obtain the single pellet on significantly more trials than the rats without pretraining. A tendency was found for the rats with previous training to ignore the pile of pellets in the alley longer than the group with no training even when the one pellet reward in the goal box was removed. Stolz and Lott concluded that these results were due to the fact that training increased the tendency of the animals to traverse the entire length of the alley to obtain food.

In a similar study, Leung, Jensen, and Tapley (1968) trained 120 rats to run a maze to obtain a single pellet reward. One half of the rats were trained with 75 reinforced trials and the other half were trained with 285 reinforced trials. These training sessions were then followed by testing in a choice situation in which the rats had to run over a pile of food pellets in order to reach the single food pellet reward at the end of the maze. The findings were that the rats which had been reinforced more during training would freeload more before running to the goal for food. The rats which had received the greatest number of prechoice trial runs were less likely to continue running the entire length of the maze than were those rats which had experienced fewer prechoice training runs. These results are in conflict with Jensen (1963) and Stolz and Lott (1964). Leung et al. distinguished between the operant responses of maze running and barpressing and noted that

these operants should not be considered identical alternatives. It was concluded that different operants have different amounts of intrinsic appeal. These results were replicated in a follow-up study by Jensen, Leung, and Hess (1970).

After Leung, Jensen, and Tapley (1968) found that the choice of independent variables may well affect the existence of the PEE, researchers began to investigate variables which were thought to influence this phenomena. Singh (1970) has reported a series of experiments investigating the effect of prior training on the preference for working over freeloading. Singh discussed Hull's (1943) concept of habit strength as it related to the prior training received by animals before they are placed in the choice situation. Singh explored the hypothesis that animals may prefer to barpress for food rather than freeload when the habit strength for barpressing is higher than the habit strength for eating freely. To investigate this hypothesis, Singh used an apparatus with two chambers. When the work condition was in effect for the animal, a retractable bar was present in one side of the apparatus and, when the freeload condition was in effect, a free food cup was present. Before being placed in the choice situation, 30 rats were given five days of work and five days of freeload training. Throughout training the rate of reinforcement on the freeload side was determined by the rate established by the rat on the work side. After training was completed, the divider between the two compart-

ments of the apparatus was removed, thus permitting the rat to move from the work side to the freeload side. Each rat was then tested by placing it in the middle of the apparatus The number of times the rat moved from one side to the other as well as the number of reinforcements obtained on each side were recorded. Singh found that the rats obtained significantly more food from the work side than from the freeload side. Since equal amounts of training were provided in both conditions, Singh concluded that habit strength was insufficient to account for the animal preference of barpressing over freeloading.

In a second experiment, Singh (1970) investigated the possibility that rats preferred to work rather than freeload because they could obtain reinforcement at a faster rate on the work side than on the freeload side. Singh used the same procedure as described above with the modification that all animals were trained on a fixed interval schedule in which the first response after a 30 second interval was reinforced. On the freeload side of the apparatus, a single pellet was dispensed every 30 seconds. This procedure eliminated the possibility that the rat could receive reinforcement faster on the work side than on the freeload side. As Singh had observed previously, he found that rats obtained significantly more food by working than by freeloading.

In a third experiment, Singh (1970) provided free food in both training and testing at a faster rate than the rat

could obtain by working in order to determine if the preference for working would still be evident. Three groups of rats obtained food on the freeload side at 12.5%, 25%, or 50% faster than at the rate at which they could obtain reinforcement on the work side. Singh found that rats in the 12.5% and 25% faster rate of reinforcement groups obtained significantly more food by freeloading. He concluded that changing the incentive properties of freeloading altered the preference for barpressing.

The variables of work history and freeload history have also been investigated by Tarte and Snyder (1973). They conducted a series of experiments to determine the effects of varying the strengths of the habit to respond for food and of the habit to eat food freely. They hypothesized that the preference for earned food found in earlier studies may have been the result of the training procedure involving massed reinforced barpressing without any opportunity for free food consumption. In the first part of the experiment, rats were given three daily 1-hour sessions as training to eat food freely provided in a metal dish on the floor of the operant chamber. Following the free food training, the animals received six daily 1-hour sessions to practice pressing a bar for food. When later exposed to a testing situation in which the animals could choose between working and freeloading, it was found that all but one animal showed strong tendencies to earn the food by barpressing. A later part of the same

study consisted of an attempt by the researchers to equate the amounts of time spent by the animals in both free food and barpress training. Tarte and Snyder noted that when time was experimentally equated, the animals preferred to eat the free food. In the final study of the reported series, an effort was made to make the number of pellets obtained by eating free food prior to testing equal to the number of pellets earned in the prechoice barpress training sessions. The training procedure consisted of alternate days of barpressing on a continous reinforcement schedule (CRF) for 150 pellets or consumming 150 pellets from the free food dish. In the subsequent choice situation in which the animal could either barpress for food or eat from a free food dish filled with 300 pellets, a similar preference for free food was found. Tarte and Snyder hypothesized that the difference between their findings and those of Singh (1970) might be due to the attractiveness of their free food. Singh presented the free food pellets one at a time whereas Tarte and Snyder presented 300 pellets at once.

Liquid reinforcers. Several of the studies described thus far have provided animal subjects a choice between working or freeloading in order to obtain solid food reinforcers (Havelka, 1956; Jensen, 1963; Carder & Berkowitz, 1970). Carder (1972) explored the effect of the type of reinforcer on the PEE by comparing water and food as reinforcers. Maintaining that rats have a tendency to manipulate their food, Carder hypothesized that since the con-

summatory pattern of rats for water did not involve such manipulation, no preference should be observed when the animals were given the choice either to work or freeload for a water reinforcer. Eight food deprived rats were trained to barpress for a 10% sucrose solution and six water deprived rats were trained to barpress for water. The subjects in both groups were then placed in a choice situation where they also had free access to the reinforcer. The results of the study indicated, as expected, that the rats deprived of food preferred to work for sucrose rather than take it freely by earning 83% of their total consumption by working. The rats deprived of water preferred free water and worked for only 26% of their total consumption. It was concluded that there was a definite preference in rats to press for sucrose, indicating that consummatory patterns of the species were important in determining the preference observed in the choice situation. An alternative explanation pointed out possible quality differences in the reinforcing properties of sucrose and water. A second study tested the preference for barpressing in relation to increasing concentrations of quinine to the sucrose solution. The quinine adulteration produced a linear reduction in the rate of responding for the reinforcer and a preference for the free solution. It was concluded by Carder that the differences found between food and water reinforcers in maintaining responding in the presence of a free reinforcer might be differences in

quality and energy production.

In contrast with the Carder (1972) findings, Knutson and Carlson (1973) found that operant behavior for both food and water continued with free access to the reinforcer. Twelve rats were randomly assigned to one of two groups. One group was trained to barpress for food pellets, the other to barpress for water. Both groups were given free access to the reinforcer during the last two CRF sessions before being placed in the choice situation. Knutson and Carlson found that both groups preferred to work for reinforcement even in the presence of the free reinforcement.

In an effort to explore further the findings of Carder (1972), Nau (Note 2) investigated whether the PEE was present when water was the reinforcer and when the amount of prechoice barpress experience was varied. Twelve experimentally naive albino rats were randomly assigned to one of four treatment conditions. The animals earned their total water intake by barpressing in either 1, 5, 15, or 25 daily 30 minute sessions prior to choice testing. As the amount of barpress training increased, the percentage of earned water consumed also increased. Those who were trained for 25 days earned 88% of their total water intake while those who were trained for 0 days earned only 12% of their total water consumption. Overall, the rats were found to show a preference to work which is in conflict with the findings of Carder (1972). The differences were explained partially by the longer work history of the rats

in the Nau study. It was concluded that the PEE does occur when water is used as the reinforcer.

Strain of rat. The studies described above have utilized several strains of rats and this may be a variable which could influence the observed preference to work or to freeload. Hanel (Note 1) investigated the effect of different rat strains on the PEE by comparing three strains of rats (i.e., Max Hooded, Wistar, and Sprague Dawley). He employed six rats of each strain, three males and three females of each. All subjects were trained to barpress for a single food pellet and were then placed in a choice situation. In the choice situation, the rats were able to barpress for food or eat freely accessible food pellets. Hanel did not find any significant differences in work preferences due to the large individual differences that were observed. However, the average percentage earned was 54% for the Max Hooded strain, 45% for the Wistar strain, and 23% for the Sprague Dawley strain. Hanel concluded that the PEE was more likely to be demonstrated if Hooded rats were used as subjects rather than the two other strains.

In conclusion, research findings have supported the existence of the PEE (Havelka, 1956; Jensen, 1963; Stolz & Lott, 1964; Singh, 1970; Carder, 1972; Knutson & Carlson, 1973; and Nau, Note 2). Findings have shown that under certain conditions an organism will prefer to work for reward rather than freeload for the identical reward. Work history is one of those conditions which influences the

PEE. The longer the work history, the more likely the PEE will be found without regard to the other variables being investigated. For example, Nau (Note 2) produced the PEE using water as the reinforcer and with a long work history (i.e., 25 days). On the other hand, Carder (1972) was unable to produce the PEE with water as the reinforcer and a six day work history. The type of reinforcer has also been found to affect differentially work behavior. For example, sucrose was found by Carder (1972) to produce the PEE with a six day work history. There have been no studies which directly compared water and sucrose as reinforcers producing the PEE nor have there been any studies which compared the effect these two reinforcers have on different strains of rats.

Chapter 2

Statement of the Problem

As pointed out in the Review of the Literature, there have been no direct comparisons of water and sucrose reinforcers and the effects these reinforcers may have on the PEE for different strains of rats. Because of the contradictory results and inconsistent application of variables, a direct comparison was deemed necessary. The purpose of the present study was to assess the influence of work history on the effectiveness of the two liquid reinforcers in producing the PEE and to determine the effects strains of rats would have on producing the PEE. Specifically, it was hypothesized that both water and sucrose reinforcers would produce the PEE and that those rats receiving the longer work training would barpress more for the reinforcer and would freeload less than those rats having a shorter work history. It was also hypothesized that the Max Hooded strain of rat would tend to work more in a choice situation than would Wistar rats.

Chapter 3

Method

Subjects

Twelve experimentally naive female rats from the Western Kentucky University animal colony were used as subjects. Six were Wistar and six were Max Hooded. The animals ranged in age from 60 days old to 180 days old at the start of the study. Subjects were placed on a 23 hour liquid deprivation schedule one day prior to barpress shaping. The shaping continued for two days. Purina Rat Chow was freely available in both the home cage and experimental chamber during deprivation, shaping, training, and testing sessions. Subjects assigned to the sucrose reinforcer groups were switched from water to the 10% sucrose solution two days prior to being placed on the 23 hour liquid deprivation schedule.

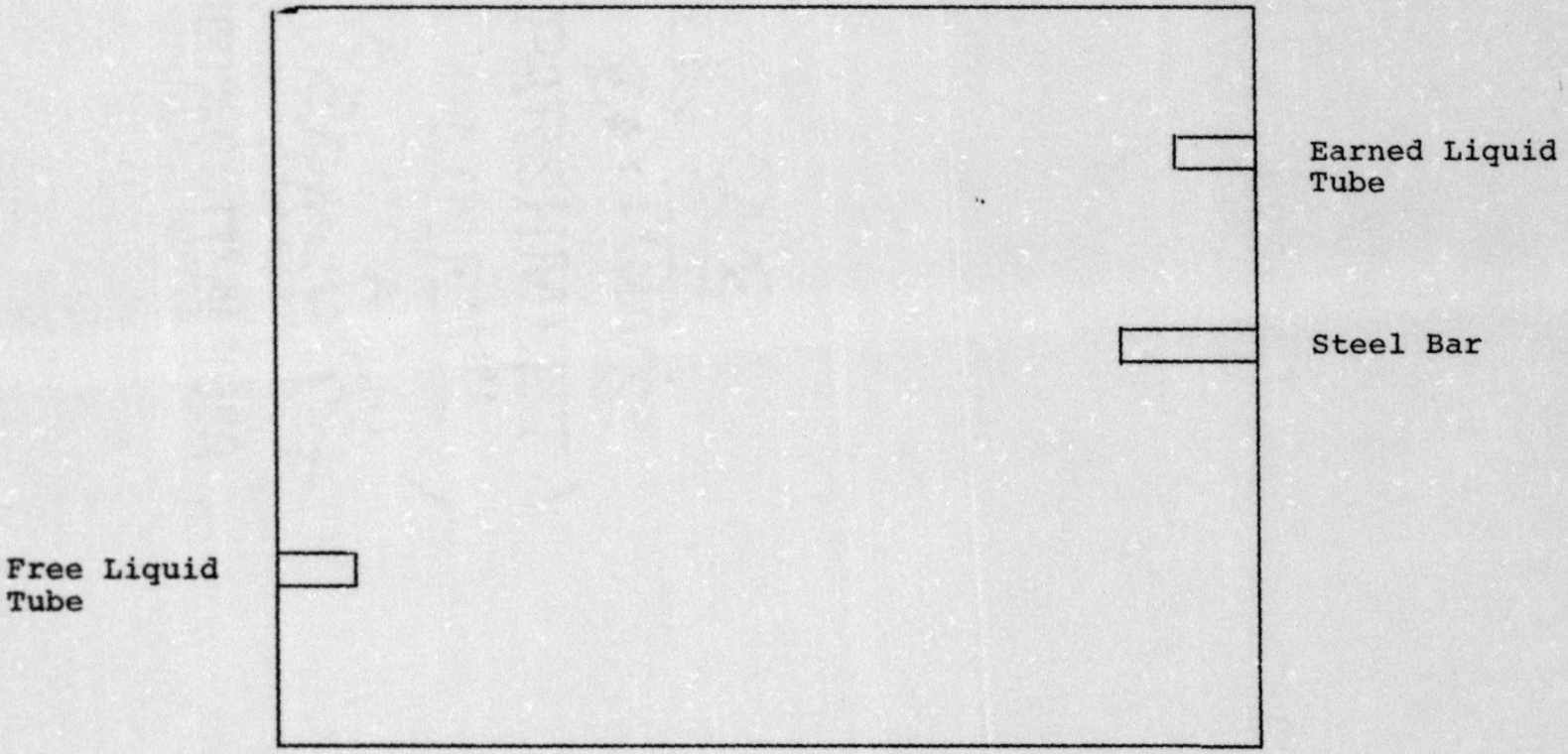
Apparatus

Six cages (20.9 cm X 24 cm X 17.7 cm) were used as the training and testing environment. As shown in Figure 1, a steel bar was mounted on the rear wall 13.4 cm from the top and 8.2 cm from the left hand wall of the cage. A water dispenser which delivered .6 ml of water or sucrose to a drinking tube which was located 13.5 cm from the top of the cage and 3.8 cm from the left hand wall of the cage. The

Figure 1

Experimental Training and Testing Chamber

Indicating Location of All Apparatus Introduced to Subjects



drinking tube extended 2.3 cm into the cage. A free liquid source was mounted on the front wall of the cage 13.1 cm from the top of the cage. Subjects received barpress training in the same cage in which they were tested. The subjects remained in these cages from the start of barpress training through the choice testing.

Design

A repeated measures design was employed with only one replication per treatment condition. There were six rats per strain. The subjects were randomly assigned to one of six treatment conditions according to strain. The between factors were strain of rat (Wistar or Max Hooded), type of reinforcer (water or sucrose), and length of work training (5, 7, or 10 days). The repeated factor was the three days of choice testing conducted after the training. The amount of earned liquid consumed and the amount of free liquid consumed were recorded for each subject during the choice testing.

Procedure

The twelve subjects were randomly assigned to the water or sucrose condition and within that condition they were randomly assigned to a work history of 5, 7, or 10 days. The Wistar and Max Hooded rats were assigned in such a manner that there was one of each strain in each of the above treatment conditions. The animals in Water 5, 7, and 10 were placed on water deprivation on Day 1 in their home cages. Twenty-three hours later they were transfered to the

experimental chamber to begin barpress shaping. The procedure for the animals receiving a water reinforcer is summarized on the left hand side of Table 1. Note that this group of rats began on the same day but completed choice testing on different days. The animals remained in the experimental chambers from the beginning of barpress shaping through work training until the termination of choice testing. When placed in the experimental chamber, they began shaping on a CRF schedule for two days. Following the shaping session, the animals immediately began to receive barpress training on the same CRF schedule for 24 hours a day. Purina Rat Chow was freely available at all times. One group received barpress training for 5 consecutive days prior to choice testing, another for 7 consecutive days, and a third for 10 consecutive days.

As the water groups began the three days of choice testing, the sucrose groups were changed from water to sucrose in preparation for their shaping, according to the schedule summarized in Table 1. The sucrose groups, as shown on the right hand side of Table 1, had a staggered beginning due to the staggered termination of choice testing for the water groups. Following the shaping, the animals received barpress training on the same CRF schedule 24 hours a day for either 5, 7, or 10 days. Following the appropriate number of days of training, the animals were given three days of choice testing.

Table 1

Procedure for Depriving, Shaping, Training, and Testing Subjects

Day	Type of Reinforcer					
	Water			Sucrose		
	Length of Work History			Length of Work History		
	5 Days	7 Days	10 Days	5 Days	7 Days	10 Days
1	Begin Water Deprivation					
2	Begin Barpress Shaping					
3						
4	Begin Barpress Training					
5						
6						
7						
8						
9						
10	Begin Choice Testing					Change to Sucrose Deprivation
11						
12		Begin Choice Testing				
13	End Testing				Change to Sucrose Deprivation	Begin Shaping
14			Begin Choice Testing			
15		End Testing		Change to Sucrose Deprivation		Begin Training
16				Begin Shaping		
17			End Testing			
18					Begin Training	
19						
20				Begin Training		
21						
22						
23						
24						
25				Begin Choice Testing		
26						
27						
28				End of Choice Testing		

Chapter 4

Results

An analysis of variance for a repeated measures design with one replication per treatment condition was performed and is summarized in Table 2. The highest order interactions were assumed not to be significant and these were used as the estimates of error to test the other interactions and main effects. Neither the type of reinforcer, the length of barpress training, strain of rat, nor their interactions were significant. (Appendices A and B show the means and variances for each animal over the three days of choice testing.)

Three analyses of variance, each of which ignored one of the three between factors, were also performed with the data. None of these revealed a significant main effect nor an interaction.

Liquid consumption was significantly greater for those subjects with a sucrose reinforcer (average 131.6 ml) than for those with a water reinforcer (average 64.2 ml), $t(34)=5.04$, $p < .005$. There was some tendency across test days for both strains to earn an increasing amount of sucrose and a decreasing amount of water.

Table 2

Summary Table of

Analysis of Variance

Source	SS	df	MS	F
A: Strain	532.37	1	532.37	1.75
C: Reinforcer	18.86	1	18.86	.06
D: Work History	4138.27	2	2069.13	6.79
AC	590.77	1	590.77	1.94
AD	2472.08	2	1236.04	4.01
CD	2698.72	2	1349.36	4.43
ACD	609.51	2	304.75	
B: Repeated Measure	1517.99	2	758.99	1.48
AB	349.21	2	174.60	.34
BC	1958.84	2	979.42	1.91
BD	2614.56	4	653.64	1.28
ABC	111.63	2	55.82	.11
ABD	1386.75	4	346.69	.68
BCD	879.39	4	219.85	.43
ABCD	2048.38	4	512.09	
Total	21927.37	35		

Chapter 5

Discussion

The results failed to reveal any significant effects due to manipulation of the variables under investigation. However, some tendency for the longest period of barpress history (10 days) to result in preference to earn a water reinforcer was noted. This tendency is consistent with the findings of Nau (Note 2), Jensen (1963), and Leung et al. (1968) and also suggests that the amount of prechoice operant training may be an important variable affecting the PEE. The differences in the findings of the present investigation in comparison to the results obtained by Nau (Note 2) may in part be a function of the massed training employed rather than the distributed, 30 minute daily sessions utilized by Nau. A replication might utilize longer training periods, equate total number of barpress responses, or make a more direct comparison of massed and distributed practice.

Contrary to the hypothesis that Max Hooded rats would demonstrate a greater preference to earn liquid reinforcers, there was no difference observed between the strains. In terms of the amount of barpress training received, the only animals displaying a preference to barpress were Hooded rats with 10 days of barpress training. In contrast, the Wistars did not show a preference for working, although they

did earn more water than sucrose. This is not inconsistent with the findings of Hanel (Note 1) who found that the Max Hoodeds tended to prefer to work more than the Wistars did. It should be noted that the type of reinforcer employed in the present study was different than that utilized by Hanel. The different strains may have preferences to earn different types of reinforcers. Further investigation may find that certain strains may prefer to earn one reinforcer over another.

In terms of total amounts of consumption, both strains consumed much greater amounts of sucrose than water (i.e., over twice as much sucrose as water). Food was available at all times and sucrose was not presented as a food substitute. Carder (1972), who found that sucrose did produce the PEE, presented the sucrose reinforcer as a food substitute. The sucrose reinforcer served as both the food and liquid intake of the rats. Differences in sucrose producing the PEE between the present study and Carder's may be caused by different presentations of sucrose.

Across test days, both strains of rats tended to earn decreasing amounts of water and increasing amounts of sucrose. The tendency to earn decreasing amounts of water is consistent with the findings of Knutson and Carlson (1973). Carder (1972) does not report if there were any changes in the preference to earn either of the reinforcers across days. In addition to the differences in total consumption of the two reinforcer, there may be a relationship between

the type of reinforcer and the test day which affects the preference to freeload.

In terms of future research, the results of the present study suggest examination of the effects of massed and distributed training to determine if the form in which the training is provided is an important variable and, if so, which would most enhance the PEE. Future investigations might also explore the relationship between different strains and different reinforcers. Different strains may have a preference to earn one reinforcer rather than another. Future research might also compare different presentations of sucrose. A sucrose reinforcer serving only to provide liquid intake may affect the PEE differently than sucrose serving as both liquid and food intake. A replication of the present study, in all or part, is recommended as there was only one subject per treatment condition and there could be no measure of within cell variance.

Reference Notes

1. Hanel, J. A Comparison of the Protestant Ethic Effect Among Strains of Rats. Unpublished master's thesis, Western Kentucky University, 1976.

2. Nau, K. L. The Influence of Work History on the Protestant Ethic Effect. Unpublished master's thesis, Western Kentucky University, 1975.

References

Alferink, L. A., Crossman, E. K., & Cheney, C. D. Control of responding by a conditioned reinforcer in the presence of free food. Animal Learning and Behavior, 1973, 1, 38-40.

Carder, B. Rats' preference for earned in comparison with free liquid reinforcers. Psychonomic Science, 1972, 26, 25-26.

Carder, B., & Berkowitz, K. Rats' preference for earned in comparison with free food. Science, 1970, 167, 1273-1274.

Davidson, A. B. Factors affecting keypress responding by rats in the presence of free food. Psychonomic Science, 1971, 24, 135-137.

Havelka, J. Problem-seeking behavior in rats. Canadian Journal of Psychology, 1956, 10, 91-97.

Jensen, G. D. Preference for bar pressing over "freeloading" as a function of number of rewarded presses. Journal of Experimental Psychology, 1963, 65, 451-454.

Jensen, G. D., Leung, C. M., & Hess, D. T. "Freeloading" in the skinner box contrasted with "freeloading" in the runway. Psychological Reports, 1970, 27, 67-73.

Knutson, J. F., & Carlson, C. W. Operant responding with free access to the reinforcer. A replication and extension. Animal Learning and Behavior, 1973, 1, 133-136.

Leung, C. M., Jensen, G. D., & Tapley, R. P. "Freeloading" in a runway as a function of amount of training and type of reinforcement schedule. Psychological Reports, 1968, 22, 211-214.

Neuringer, A. J. Animals respond for food in the presence of free food. Science, 1969, 166, 399-401.

Singh, D. Preference for barpressing to obtain reward over freeloading in rats and children. Journal of Comparative and Physiological Psychology, 1970, 73, 320-327.

Stephens, R. M., Metze, L. P., & Craig, J. R. The protestant ethic effect in a multi-choice environment. Bulletin of the Psychonomic Society, 1975, 6, 137-139.

Stolz, S. B., & Lott, D. F. Establishment in rats of a persistent response producing a net loss of reinforcement. Journal of Comparative and Physiological Psychology, 1964, 57, 147-149.

Tarte, R. D., & Snyder, R. L. Some sources of variation in the bar pressing versus freeloading phenomenon in rats. Journal of Comparative and Physiological Psychology, 1973, 84, 128-133.

Appendix A

Mean Percentage of Liquid Earned

By Barpressing Across Test Days

Group	Subject	Mean Percentage
Wistar		
Water		
5	1	46.1
7	2	23.1
10	3	50.6
Sucrose		
5	4	33.4
7	5	36.1
10	6	30.5
Max Hooded		
Water		
5	7	2.2
7	8	3.7
10	9	66.6
Sucrose		
5	10	26.7
7	11	30.9
10	12	43.5

Appendix B

Mean Percentage and Variance of Liquid

Earned by Barpressing Across Test Days

Group	Subject	Mean Percentage	Variance
Wistar Water			
5	1	46.1	50.13
7	2	23.1	63.55
10	3	50.6	62.17
Sucrose			
5	4	33.4	1932.34
7	5	36.1	98.34
10	6	30.5	25.59
Max Hooded Water			
5	7	2.2	9.24
7	8	3.7	26.64
10	9	66.6	72.32
Sucrose			
5	10	26.7	137.68
7	11	30.9	44.94
10	12	43.5	1099.24